

NAME: ELKWO EDZOR CHUSAZA UCHENNA
 DEPARTMENT: ELECTRICAL/ELECTRONICS ENGINEERING.
 MATRIC No: 191EAG041015
 DATE: 10/2/2021
 SERIAL NUMBER: 19

(1) $A = 4i + j - 2k$ $B = 3i - 2j + k$ $C = i - 2k$

(a) $(A - 2B) \times C$

$$\begin{aligned} A - 2B &= 4i + j - 2k - 2(3i - 2j + k) \\ &= 4i + j - 2k - 6i + 4j - 2k \\ &= -2i + 5j - 4k \end{aligned}$$

$(A - 2B) \times C =$

$$\begin{aligned} &(-2i + 5j - 4k) \times (i - 2k) \\ &= \begin{vmatrix} i & j & k \\ -2 & 5 & -4 \\ 1 & 0 & -2 \end{vmatrix} = +i \begin{vmatrix} 5 & -4 \\ 0 & -2 \end{vmatrix} - j \begin{vmatrix} -2 & -4 \\ 1 & -2 \end{vmatrix} + k \begin{vmatrix} -2 & 5 \\ 1 & 0 \end{vmatrix} \\ &= -10i - 8j - 5k \end{aligned}$$

(b) $A \times (2C \times 3B)$

$$\begin{aligned} 2C \times 3B &= 2(i - 2k) \times 3(3i - 2j + k) \\ &= (2i - 4k) \times (9i - 6j + 3k) \end{aligned}$$

$$\begin{aligned} &= \begin{vmatrix} i & j & k \\ 2 & 0 & -4 \\ 9 & -6 & 3 \end{vmatrix} = +i \begin{vmatrix} 0 & -4 \\ -6 & 3 \end{vmatrix} - j \begin{vmatrix} 2 & -4 \\ 9 & 3 \end{vmatrix} + k \begin{vmatrix} 2 & 0 \\ 9 & -6 \end{vmatrix} \\ &= -24i - 42j - 12k \end{aligned}$$

$A \times (24i - 42j - 12k) = (4i + j - 2k) \times (24i - 42j - 12k)$

$$\begin{aligned} &= \begin{vmatrix} i & j & k \\ 4 & 1 & -2 \\ -24 & -42 & -12 \end{vmatrix} = +i \begin{vmatrix} 1 & -2 \\ -42 & -12 \end{vmatrix} - j \begin{vmatrix} 4 & -2 \\ -24 & -12 \end{vmatrix} + k \begin{vmatrix} 4 & 1 \\ -24 & -42 \end{vmatrix} \\ &= -96i + 96j - 144k \end{aligned}$$

(2) $A = pi - 6j - 3k$ $B = 4i + 3j - k$ $C = i - 3j + 2k$

A, B and C are coplanar when $A \cdot (B \times C) = 0$

$$\begin{aligned} &\begin{vmatrix} p & -6 & -3 \\ 4 & 3 & -1 \\ 1 & -3 & 2 \end{vmatrix} = +p \begin{vmatrix} 3 & -1 \\ -3 & 2 \end{vmatrix} + 6 \begin{vmatrix} 4 & -1 \\ 1 & 2 \end{vmatrix} - 3 \begin{vmatrix} 4 & 3 \\ 1 & -3 \end{vmatrix} \\ &= 3p + (6 \times 9) - (3 \times -15) = 0 \\ &= 3p + 54 + 45 = 0 \\ &3p = -54 - 45 = -99 \quad \therefore p = \frac{-99}{3} = -33 \end{aligned}$$